

and 1893 near the times of the sun-spot maxima, and that the highest result occurs in 1889 at the time of the sun-spot minimum.

These effects are reproduced in the twenty-four hour mean temperature column, but without doubt we ought to look to the mean of the daily maxima throughout the year to show any variation in the intensity of solar radiation. This may be done in the same manner that the connection between the sun-spot period and the rainfall in Jamaica¹ was shown, by taking the mean of any three years as the mean of the middle year, and thus reducing the irregularities. Applying this process to the mean maximum temperature we get the following table:

Mean maximum temperatures (smoothed).

1882	86.8
1883	86.5
1884	86.7
1885	87.4
1886	88.1
1887	88.7
1888	88.9
1889	88.8
1890	88.3
1891	87.4
1892	86.9
1893	86.6
1894	86.9
1895	87.3
1896	87.7
1897	87.5

It seems advisable to give in fig. 1 the three curves for sun-spot frequency and mean maximum temperature and rainfall in Jamaica, the two latter curves being smoothed by taking the mean of the results for any three years as the mean result for the middle year.

In the rainfall curve irregularities will be noticed, as shown by the dotted curves. From the middle of 1887 to the middle of 1890 the rainfall was less than it should have been. From the middle of 1891 to the end of 1895 it was greater than it should have been.

Attention is strongly called to these irregularities, because in 1892 it was assumed that the curve would recover its position, and in consequence a smaller rainfall for the next few years was predicted; but 1893 proved unusually wet, producing the smoothed maximum for the middle of 1892.

The following table gives the rainfall in Jamaica as deduced from about ninety stations:²

Annual rainfall for Jamaica.

Year.	Rainfall.	Average for 3 years.	Year.	Rainfall.	Average for 3 years.
1866	Inches.	Inches.	1884	Inches.	Inches.
1867	59.65	61.95	1885	56.90	58.67
1868	64.47	61.95	1886	59.86	59.12
1869	67.74	62.53	1887	90.61	73.71
1870	55.87	70.85	1888	70.66	77.79
1871	59.48	64.96	1889	72.11	73.81
1872	50.09	61.57	1890	74.15	70.23
1873	45.18	58.78	1891	64.42	74.42
1874	63.06	59.06	1892	84.70	74.03
1875	68.94	61.47	1893	72.98	81.39
1876	52.42	64.24	1894	86.49	78.29
1877	71.35	64.06	1895	75.39	77.83
1878	68.40	73.06	1896	71.62	71.87
1879	76.42	77.89	1897	68.61	72.61
1880	68.84	73.57	1898	77.59	73.35
1881	55.44	70.96	1899	78.84	79.08
1882	68.60	60.64	1900	85.82	76.44
1883	57.87	61.91		69.65
	59.26	58.01			

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the con-

tents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

- Pearson's Magazine.* London. Vol. 12.
Lyle, Eugene P. Shooting away Hailstorms. Pp. 651-660.
Scientific American. New York. Vol. 85.
Campbell, W. W. The Lick Observatory; Crocker Eclipse Expedition to Sumatra. P. 331.
 — Irrigation of the Delta of the Colorado. P. 358.
Scientific American Supplement. New York. Vol. 52.
 — Count de la Vaulx Balloon "Méditerranéen." P. 21648.
Science. New York. Vol. 14.
Mitchell, S. A. Total Eclipse of the Sun. Pp. 802-807.
Ward, R. DeC. Physiological Effects of Diminished Air Pressure. P. 814.
 — The Weather Bureau. P. 817.
 — Monthly Weather Review. Pp. 817-818.
Rotch, A. Lawrence. Meteorological Observations with Kites at Sea. Pp. 896-897.
Popular Science Monthly. Lancaster. Vol. 60.
Clayton, H. Helm. The Influence of Rainfall on Commerce and Politics. Pp. 158-166.
 — Meteorology. (Agricultural Yearbook.) P. 186.
 — The Effect of Secular Cooling and Meteoric Dust on the Length of the Day. Pp. 190-191.
National Geographic Magazine. New York. Vol. 12.
McGree, W. J. Ice Caves and Frozen Wells. Pp. 433-434.
Bulletin of the American Geographical Society. New York. Vol. 33.
Ward, Robert DeC. Some Economic Aspects of the Heat and Drought of July, 1901, in the United States. Pp. 338-348.
Ward, Robert DeC. Notes on Climatology. Pp. 350-353.
Symons's Meteorological Magazine. London. Vol. 36.
Mossman, R. C. New Highland Meteorological Station. Pp. 157-159.
 — The Study of London Fog. P. 159.
MacDowall, Alex. B. and Mill, Hugh Robert. The Moon and Rainfall. Pp. 165-167.
Buchan, Alex. Report of the Committee of the British Association on Meteorological Observations on Ben Nevis for 1900. Pp. 160-163.
 — Climate of the British Empire, 1900. Pp. 167-168.
Proceedings of the Royal Society. London. Vol. 68.
Shaw, W. N. On the Seasonal Variation of Atmospheric Temperature in the British Isles and its Relation to Wind-direction, with a Note on the Effect of Sea Temperature on the Seasonal Variation of Air Temperature. Pp. 61-85.
Nature. London. Vol. 65.
 — The Observatory of Mont Blanc. Pp. 31-32.
 — Geology and Meteorology. Pp. 32-33.
Shaw, W. N. Some Seasonal Variations in the British Isles. Pp. 68-69.
Physical Review. Lancaster. Vol. 13.
Nichols, E. F. and Hull, G. F. A Preliminary Communication on the Pressure of Heat and Light Radiation. Pp. 307-320.
Astrophysical Journal. Chicago. Vol. 14.
Rogovsky, B. On the Temperature and Composition of the Atmospheres of the Planets and the Sun. Pp. 234-260.
La Nature. Paris. 29me Année.
Herve, Henri. Expériences d'aéronautique maritime. Pp. 391-395.
Parville, Henri de. Les deux soleils. Pp. 419-420.
Courdevache, P. Électricité atmosphérique. Pp. 427-428.
M. P. de. Pyromètre à air bristol. Pp. 428-429.
Deniza, N. Concours d'aviation. Pp. 431-432.
Annales de Géographie. Paris. 10me Année.
Zimmermann, Maurice. Quelques résultats de l'expédition antarctique belge. Pp. 454-461.
Comptes Rendus de l'Académie des Sciences. Paris. Tome 133.
Birkeland, —. Les taches du Soleil et les planètes. Pp. 726-729.
Raulin, V. Sur les variations séculaires du magnétisme terrestre. 760-763.
Herve, H. Expériences d'aéronautique maritime. Pp. 763-766.
Blondlot, R. Sur l'absence de déplacement électrique lors du mouvement d'une masse d'air dans un champ magnétique. Pp. 778-781.
Chassy, A. Sur la formation de l'ozone. Pp. 789-791.
Becquerel, Henri. Sur une modification dans l'emploi du thermomètre électrique pour la détermination des températures souterraines au Musée d'Histoire naturelle. Pp. 800-803.

¹ Nature. Vol. 49. P. 399.

² The tabular sun-spot numbers are given on page 506 of the current REVIEW.

- Blondlot, R.** Sur l'absence d'action d'un champ magnétique sur une masse d'air qui est le siège d'un courant de déplacement. Pp. 848-850.
- Raverot, Emile et Belly, Pierre.** Loch manométrique différentiel. Pp. 811-813.
- Ciel et Terre. Bruxelles.** 22me année.
- Bartlett, A. K.** La lune sèche et la lune humide. Pp. 433-437.
- Prinz, W.** De l'influence des courants de convection sur les indications d'instruments très mobiles. Pp. 437-447.
- Nouveau mode d'emploi du cerf-volant pour les recherches météorologiques. Pp. 455-456.
- Coup de foudre intéressant. P. 456.
- Sitzungsberichte der königlich preussischen Akademie der Wissenschaften. Berlin.** No. 42. 1901.
- Kohlrausch, Friedrich.** Über den Temperatureinfluss auf das elektrische Leitvermögen von Lösungen, insbesondere auf die Beweglichkeit der einzelnen Ionen im Wasser. Pp. 1026-1033.
- Zeitschrift für Instrumentenkunde. Berlin.** 21 Jahrgang.
- Schloesser, W.** Thermometrische Untersuchungen. Pp. 281-298.
- Himmel und Erde. Berlin.** 14 Jahrgang.
- Suring, R.** Die Ergebnisse der Berliner wissenschaftlichen Luftfahrten. Pp. 49-70.
- Naturwissenschaftliche Rundschau. Braunschweig.** 16 Jahrgang.
- Wesendonk, K. v.** Zur Erklärung des Phänomens der blauen Sonne. 573-574.
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- Gravelius, H.** Die Hydrographie in den Vereinigten Staaten. Pp. 143-157.
- Gravelius, H.** Siedek's neue Geschwindigkeitsformel. Pp. 165-169.
- Annalen der Physik. Leipzig.** Vierte folge. Band 6.
- Grunmach, Leo.** Experimentelle Bestimmung der Oberflächen Spannung flüssiger Luft. P. 559-564.
- Revista de Ciencias. Habana.** Año 1.
- Muxo, Alejandro.** Auroras Polares. Pp. 195-197.
- Memorie della Società degli Spettroscopisti Italiani. Catania.** Vol. 30.
- Frequenza delle macchie solari nell'anno 1900 e confronto dell'andamento colla variazione magnetica. Pp. 213-215.
- Meteorologische Zeitschrift. Wien.** Band 18.
- Toepfer, M.** Ueber die Richtung der elektrischen Strömung in Blitzen. Pp. 481-487.
- Kostersitz, K.** Zur Frage der Errichtung eines astrophysikalisch meteorologischen Höhenobservatoriums im Semmeringgebiete. Pp. 487-497.
- Ernst, J. W.** Graphische Wetterbeschreibung. Pp. 497-504.
- Draenert, F. M.** Das Klima im Thale des Amazonas-Stromes. Pp. 504-515.
- Mohn, H.** Absolute Maximum-Temperaturen in Norwegen. Pp. 515-518.
- Trabert, W.** Die Extinktion des Lichtes in einem trüben Medium (Sehweite in Wolken). Pp. 518-524.
- Rotch, [A.] L. und Hann, J.** Ein neues Feld für die Erforschung der höheren Luftsichten mittelst Drachen. Pp. 524-526.
- Kassner, O.** Hagelthurmwolken. Pp. 526-528.
- Mazelle, —.** Ausserordentliche Regenintensität. Pp. 528-529.
- Hann, J. J. R. Sutton über die Winde von Kimberley.** Pp. 529-533.
- Toepfer, M.** Fragen zur Erforschung der Kugelblitze. Pp. 533-534.
- Fenyi, J.** Ein Resultat der Gewitterregistrierung in Kalocsa. Pp. 534-536.
- Fenyi, J.** Zur Theorie des Gewitterregistrator. Pp. 536-537.
- Engelen, —.** Gewitter-Registriapparat. Pp. 537-538.
- Meteorologisches Observatorium auf den Azoren. P. 538.
- Riggengbach-Burkhardt, A.** Zum Klima von Ober-Mesopotamien. Pp. 538-539.
- Woeikof, A.** Der Juni 1901 in Südostrussland. Pp. 539-540.
- Gerlich, K.** Schlauchförmige Wolken. P. 540.
- Poccobetino, —.** Ergebnisse einiger Messungen der Elektricitätszerstreitung in freier Luft. Pp. 540-542.
- Ueber die Störungen des normalen atmosphärischen Potentialgefälles durch Bodenerhebungen. Pp. 542-543.
- Resultate der meteorologischen Beobachtungen in Guatemala im Jahre 1899. P. 543.
- Ausserordentlicher Regenfall auf Lussin piccolo. P. 543.
- Das Wetter. Berlin.** 18 Jahrg.
- Aßmann, R.** Der Aspirations-Meteorograph. Pp. 241-247.
- Klenzel, Friedrich.** Ueber das Wetterschiessgebiet bei Windisch-Feistritz im südlichen Steiermark. Pp. 247-251.
- Hennig, Richard.** Extreme Witterungs-Erscheinungen. Pp. 251-256.
- Boernstein, R.** Vom zweiten Berliner Wetterkursus. Pp. 256-258.
- Dunkle Blitze. Pp. 260-262.
- Der Wetterdienst der Landwirtschaftsschule zu Weilburg im Sommer 1901. Pp. 262-264.

NOTES BY THE EDITOR.

RELATIVE FREQUENCY OF SUN SPOTS.

We publish herewith the complete table of the so-called relative sun-spot numbers as prepared originally by Professor Wolf, Director of the Observatory at Zurich, and revised by his successor, Prof. A. Wolfer. Professor Wolf chose the mean solar day as the unit of time, and noted day by day both the number of visible groups of spots and also the number of spots contained in each group. A combination of these two numbers gave him his relative numbers, expressing the sun-spot activity for that particular day. He considered that the formation of a new group of spots was more important than the appearance of a new spot in an already existing group, and was led to compute his relative numbers by the formula, $r = 10g + f$, where g is the number of groups visible on any day, and f the total number of spots, whether they were in the groups or isolated. That is to say, if there were eight spots so arranged as to constitute five groups the relative numbers for the day would be 58. The average of the relative numbers for each day gave the mean monthly numbers, and the average of the twelve months gave the mean annual numbers; and these are the numbers given in the accompanying tables.

A different method of computing sun-spot numbers was adopted by Schwabe, who was the original discoverer of the periodic frequency of sun spots. The computations of Wolf have extended back to the earliest observations, whereas Schwabe's discovery was based on his own observations, which

began in the year 1826. Schwabe adopted a general period of ten years, but Wolf has shown that the period is exactly 11.111 years.

The relative numbers of Wolf do not always seem to give an exact expression of the sun-spot activity, since they take no account of the size of the spot, and some have proposed to introduce this feature into the calculation. But a careful comparison of Wolf's numbers with the record of spotted areas has shown that they are in general quite nearly proportional to each other. Of course, all that we want is the relative condition from month to month and year to year.

In order to make these numbers as reliable as possible, Wolf combined together the records of different observers, using very different instruments, and each of these records was first reduced by him to something like what would have been given by a normal observer—that is, himself—using a standard instrument, namely, his 4-foot Fraunhofer refractor, whose aperture was 3 inches, and magnifying power 64.

His series of satisfactory numbers based on actual observations begins with the year 1749. Observations were, of course, on record for earlier years, but not in sufficient numbers to justify introduction into this table. In fact, many gaps exist after 1749, and can only be filled in by graphic methods of interpolation. In his original table, Wolf distinguishes two degrees of reliability, namely, the heavy print, representing satisfactory and complete sets of observations, and the starred (*) figures, representing a rather small number of observations eked out by means of interpolations.